



Safety by design

Greg Hinshaw and David P. Cooper, J.H. Fletcher & Co., US, detail the required safety measures for operating walk-through roof bolting machines.

When J.H. Fletcher & Co. ('Fletcher') was founded in 1937, the underground coal mining industry was rapidly turning to mechanisation. The company now provides mechanised equipment for the underground mining industry across the world.

In the 1940s the primary means of supporting a coal mine roof was with timbers. This was a slow and dangerous process that required teams of men to walk and work without any roof support to install heavy pieces of lumber to create a wall and ceiling of wood protection. Many men suffered serious injuries and death, trying to make the walls and ribs of the mine safe so that mining could continue. Fletcher initially designed and manufactured timbering machines. Its machines were equipped with a saw and a positioning arm so that the lumber could be cut as the machine was advanced in a working area. The aim was to promote a reduction in the amount of time that any man had to work under unsupported mining conditions (unsupported top).

Roof bolting

In 1955, the US mining industry made the move to roof bolting. Roof bolting is the process whereby metal bolts, with or

without glue (resin), are installed into the roof and ribs of a mine to bind with the geological strata and form a network of support. While not guaranteeing the prevention of a roof fall, collapse, or cave-in, the science of roof control via the installation of bolts has promoted safety and decreased the number of serious injuries and deaths in the US that occur because of falls. As the mining industry made this transition, so did Fletcher, which began designing and developing underground roof bolting machines. These machines perform the function of installation of permanent support.

Over the past 50 years, Fletcher has incorporated new technology into its product designs, based upon information received from a variety of sources, such as customers, operators and Government authorities. This article discusses one particular model of machine that is used in situations where there are special roof and rib control challenges, such as frequent and/or substantial occurrences of falling roof, ribs and cave-ins.



DDR walk-through.

Where harvested seams of coal result in increased vertical height of an entry and/or increased horizontal stress conditions, the potential for brow and rib instability can be substantial. Weak and non-uniform coal seam formations also increase the likelihood of brow and rib instability. To address such changing conditions, Fletcher has developed the HDDR, 'inside control' roof bolting machine line. In this style of machine, the operating controls are located inside the drilling boom. The operator stands on a platform. In some designs the platform raises or lowers. With a mast feed design, rib bolting can be performed. The walk-through chassis design eliminates the need for an operator to walk alongside an unsupported rib in order to install support.

In addition to its walk-through design, many of Fletcher's machines are designed for application in higher seam heights and offer a wider inside walkway and a hydraulic rear ramp to facilitate the loading materials that are necessary to install roof and rib support.

The walk-through design concept has been applied to lower profile machines with some industry acceptance, offering additional lateral hazard protection in mid-seam heights that have identified rib roll and/or brow control problems.

Safe, efficient and approved operational support sequencing of roof and rib bolt installation is promoted by the use of a walk-through machine. To perform their job, roof bolter operators are required to work under roof that is not permanently supported. This means that a roof bolting machine has to be used in a safe manner. While a roof bolting machine, such as a walk-through model, cannot prevent all roof or rib falls or deflect falling debris, if used in a safe and proper manner, it can promote a safe environment. To promote safety, the walk-through design has many features that have been developed by Fletcher and others and approved by the US Mine, Health & Safety Administration.

Operational sequence

The following is a basic operational sequence for walk-through machines with inside controls.

The roof bolting machine is trammed into the heading that has been cut by the



Material handling system.

continuous miner. The bolter operator is located in the tram deck and is protected by a MSHA certified canopy. The second operator walks behind the machine to assist with the control of the trailing cable. Sitting inside the tram deck location, the bolter operator is able to tram the machine from place to place at full operational speed (approximately 2 km/hour).

The bolter operator stops the machine so that it is in position for the next row of bolts determined by the mine plan. The two operators then proceed down the centre walkway of the machine. Inch tram controls are located inside the walkway. From the inch tram location, the bolter operator can move the machine to an active working place and set the ATRS and stabilisers. With the ATRS securely against the roof, the operators remain under supported roof while handling materials. The operators then proceed onto the platforms to begin bolting. The entire drilling and bolting procedure takes place with the operator standing on the platform, under a canopy.

On completion of bolting a full row of bolts, the operators return to the inch-tram location on the chassis, which is still under the protection of installed roof bolts. The ATRS is collapsed so that it clears the roof and floor. The stabilisers are also raised. The roof bolter is then trammed forward from this location in the walkway until it is positioned so to install the next row of roof bolts. (It is important to note that from the inch-tram location, the machine can only be trammed at approximately 1 km/hour. This is to prevent an operator from using this position to drive the bolter from place to place without sitting in the tram deck and under the protection of the MSHA certified canopy). The ATRS and stabilisers are then re-set and the bolting cycle is repeated until the complete heading is bolted.

HDDR material handling system

Many injuries in coal mines are caused by small rocks falling from the immediate top. Along with the advantages of a walk-through roof drill design, the rear of the machine has been specially designed to haul necessary supplies for roof and rib bolting. One advantage of the storage system, called a 'Material Handling System' is that it can be used to store materials, such as roof screen. These material handling systems provide the operator with immediate access to large roof bolt plates, steel straps and steel screen or mesh that is installed in the roof to prevent falling of small rock and debris.

The material handling system that is provided on the machines has an added benefit. Bolt plates, steel straps, mesh and other implements used in bolting are often heavy and awkward to carry from place to place. Attempts to carry these materials manually increase an operator's risk of back, shoulder, knee and other physical injuries.

The material handling system incorporates the use of a hydraulic winch that can be used to load heavy materials onto the mechanised screen tray, located at the rear of the machine. For instance, up to 25 sheets of screen can be loaded onto the machine at one time without the operator having to lift them. The mechanised screen tray can then be manoeuvred up, down, side to side and/or tilted to a position that is comfortable for operators when lifting sheets of screen for placement.

Materials can be loaded onto separate trays and stored on the rear of the machine. With the material handling system, loading bolting materials by hand is eliminated. Materials can be loaded onto trays by the vendor outside the mine. The trays may then be taken underground by supply cars. The loaded trays can be lifted to a proper location on the rear of the roof bolting machine by the material handling system. This promotes reduced occurrences of injuries associated with repetitive tasks, such as lifting the roof bolting materials onto the machine.

The walk-through design and material handling system described in this article are just two of many important options available for walk-through roof drills. ■